

Executive Summary

2008 *Report*

The Health of Colorado's Forests



Special Issue:
High Elevation Forests

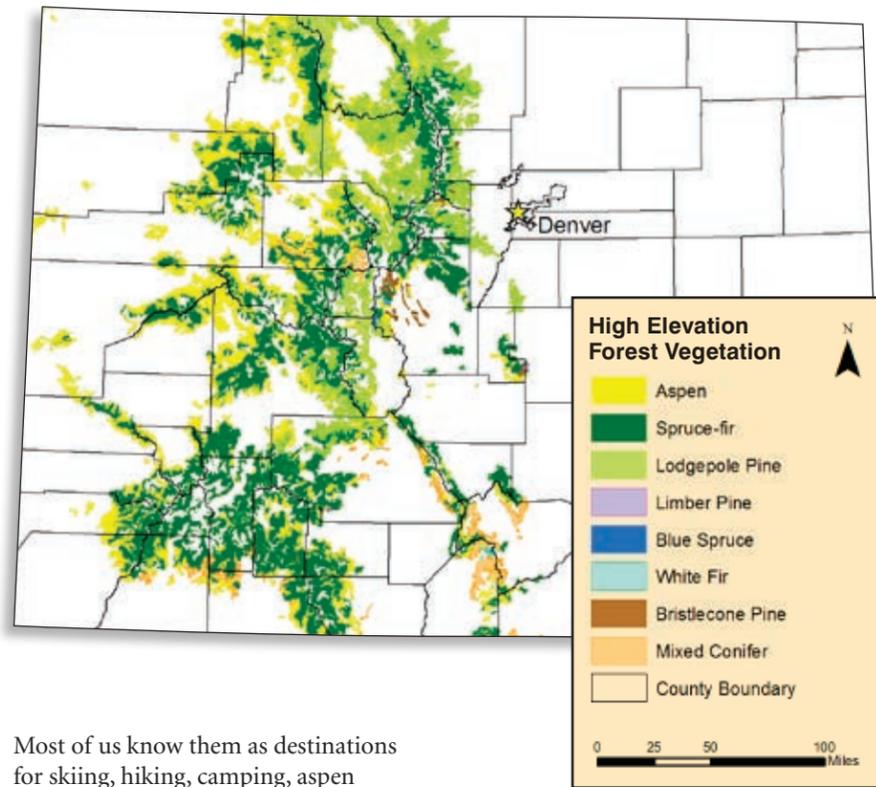




Colorado's High Country Forests

are the inspiration for postcards. They define our winter playgrounds and provide food and shelter for boreal owls, paintbrush blooms, and many other species. They yield raw material for rustic homes, exquisite paneling, and life-giving energy. They capture, purify, and release water to nurture crops in a Pacific valley and corn on our Eastern Plains. And they are the focus of the 2008 Report on the Health of Colorado's Forests.

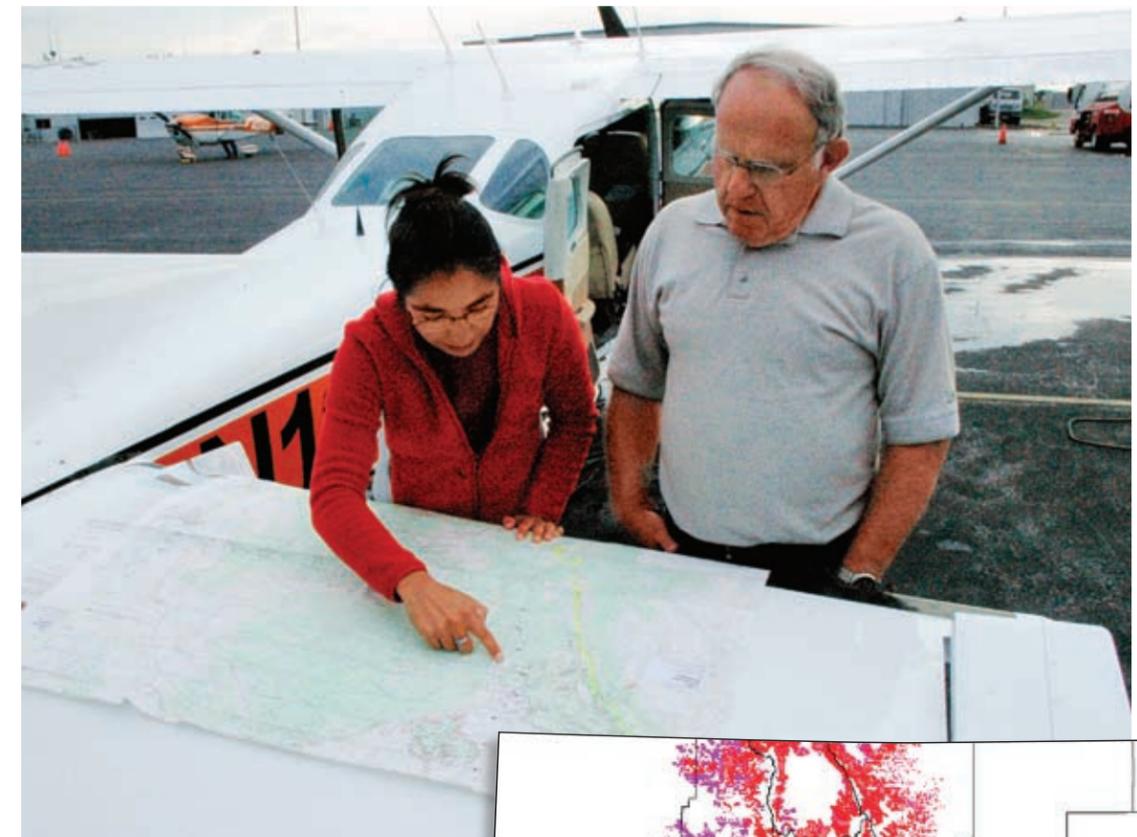
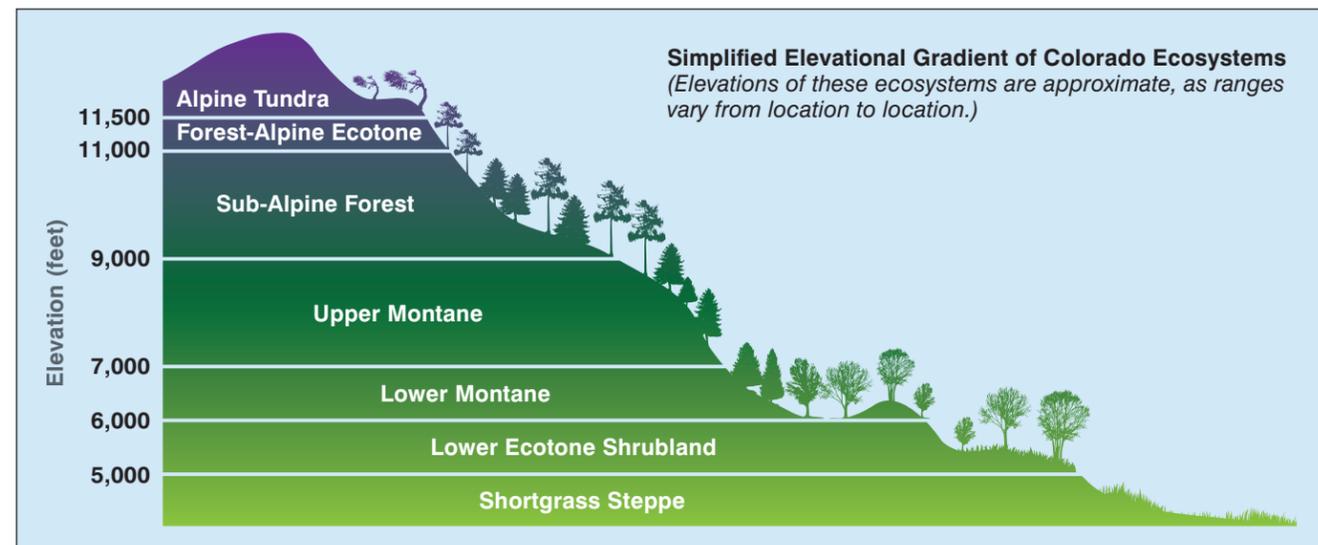
Ecologists and foresters define our lofty forests as the mixed conifer, upper montane, and subalpine zones.



Most of us know them as destinations for skiing, hiking, camping, aspen viewing, firewood gathering, hunting, and places to wow visitors. (For the purpose of this report, high country forests are defined as those occurring 9,000 feet and above in elevation.)

Change in forests is inevitable. To truly understand what is occurring in Colorado's high elevation forests, it is important to understand how these

forests die, renew, grow, and function. One way to gain some understanding is through such tools as the annual aerial survey, which provides a panoramic view of forest insect and disease infestations.



Bill Ciesla

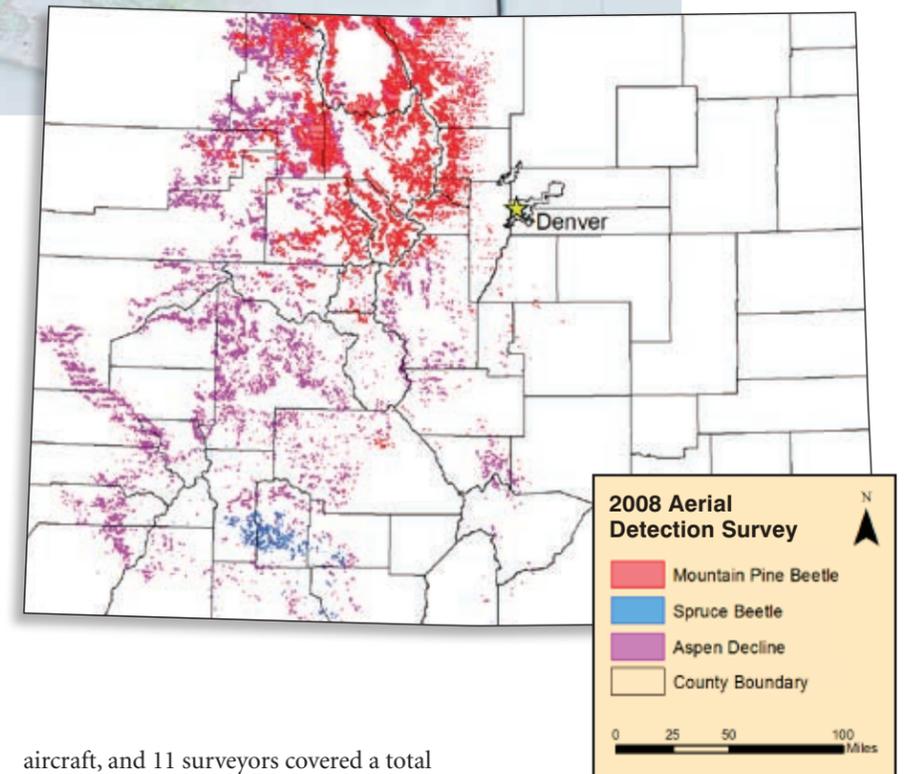
Aerial survey briefing before the flight.

What is the Annual Aerial Survey?

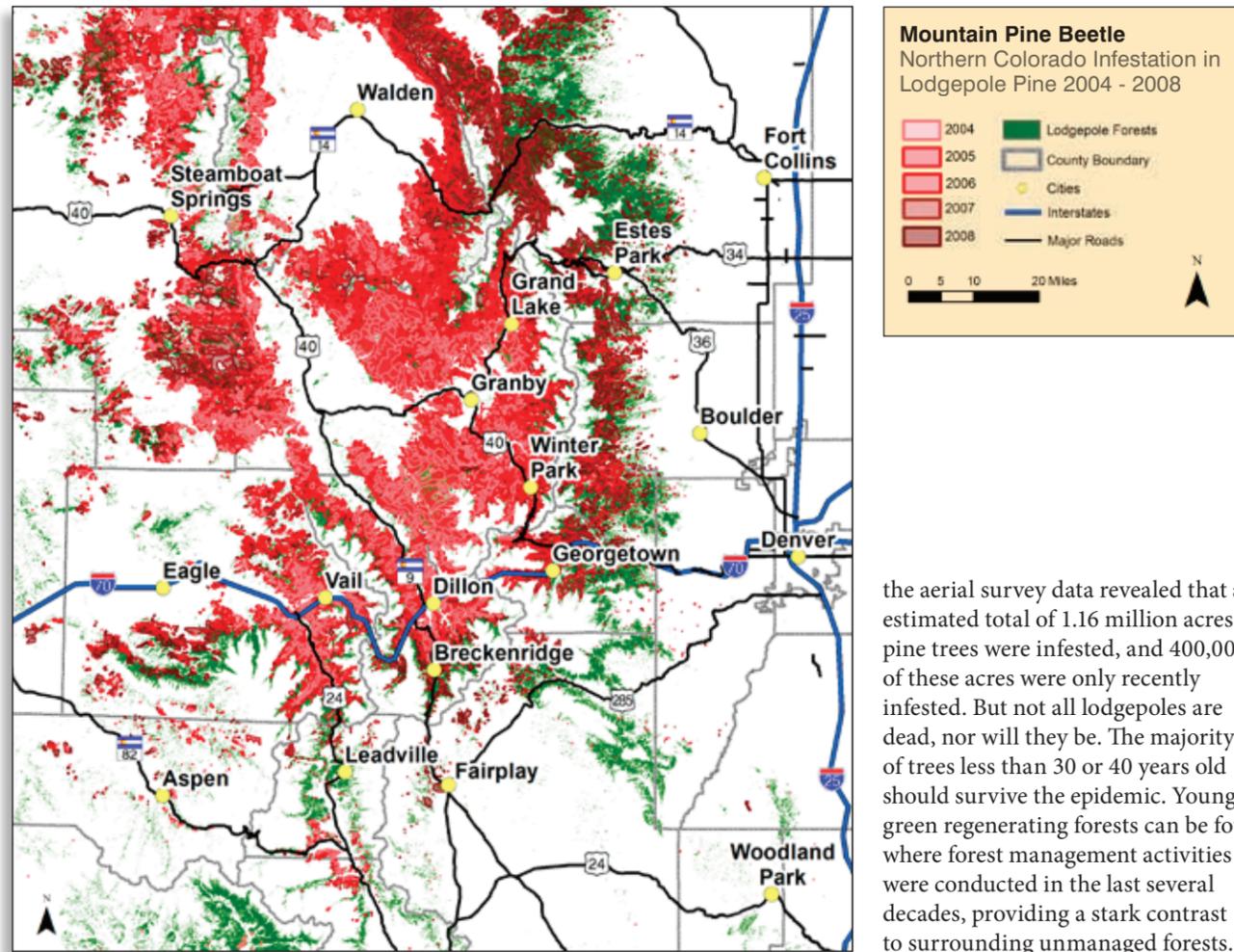
A normal aerial surveying session involves 4-5 hours of flying shotgun in a small fixed-wing aircraft with an experienced pilot over mountain terrain, 1,000-1,500 feet above the tree tops at about 100 miles an hour, straining to accurately map the location, number, and identity of obviously sick trees. Surveyors cover more than 100,000 acres in just one flight.

When performed by skilled forestry professionals, aerial surveys provide valuable trend information and early warning about emerging insect and disease infestations.

This activity, referred to as the Aerial Survey Partnership, is led, coordinated, and funded by U.S. Forest Service Forest Health Management personnel. The Colorado State Forest Service (CSFS) has assisted with this effort since the 1970s and became significantly involved in 1997. In 2008, three agencies, four



aircraft, and 11 surveyors covered a total of 43.7 million acres in Colorado and the rest of the Rocky Mountain Region (Region 2) of the U.S. Forest Service. Following is an insect and disease update based on the aerial surveys completed in Colorado in 2008.



the aerial survey data revealed that an estimated total of 1.16 million acres of pine trees were infested, and 400,000 of these acres were only recently infested. But not all lodgepoles are dead, nor will they be. The majority of trees less than 30 or 40 years old should survive the epidemic. Young, green regenerating forests can be found where forest management activities were conducted in the last several decades, providing a stark contrast to surrounding unmanaged forests.

Colorado Insect and Disease Update

Mountain pine beetle (MPB) is a cyclic insect that favors old, dense forests. Nearly all of Colorado's aging 1.5 million acres of pure lodgepole pine forests match the beetles' requirements. The result is an epidemic of massive proportions. Since 1996 when the epidemic was first noted, an estimated *cumulative* total of 1.9 million acres of forest (includes all hosts of MPB) have been infested by mountain pine beetle. This acreage consists mainly of lodgepole pine in pure lodgepole and mixed conifer stands, which include limber and bristlecone pine. In 2008, aerial surveyors noted a significant increase in the number of infested ponderosa pine trees. The analysis of



Aerial photo of beetle-killed spruce trees.

Ingrid Aguayo



Dave Leatherman

Mountain pine beetle-killed lodgepole pines on Rabbit Ears Pass.

Subalpine fir decline is caused by the balsam bark beetle and two root-disease fungi. Combined with dry, warm climate conditions, they are killing large numbers of subalpine fir. The result is a "bathtub ring" of red fir defining the lower reaches of this tree that thrives in cool, wet conditions.

Sudden aspen decline (SAD) is a somewhat new term used to describe established aspen groves that experience crown dieback over a relatively short period of a few years and do not appear to be regenerating. Many secondary organisms are associated with the dead and dying trees, but drought is suspected as the most important factor, combined with the accumulated effects of a century of fire exclusion, past grazing practices, and extensive elk browsing. Heavy snowpack in some impacted areas during the winter of 2007-08 seem to have slowed or stopped further increases in some locations, but the much-needed

moisture was not uniform statewide. Forest management activities conducted over the past 30 years have successfully regenerated aspen. These areas remain vibrant and healthy even when surrounded by older, unmanaged stands affected by sudden aspen decline. What is unknown is the length of time that trees affected by SAD will maintain healthy root systems capable of re-sprouting after above-ground mortality occurs. The 2008 aerial survey, which focused on aspen mortality and severity of damage, revealed that 542,000 acres were affected last year. While scattered throughout the mountainous range of this tree, this phenomenon is most evident in the national forests near Durango.

Spruce beetle infestations continue in many Engelmann spruce stands statewide. In the wake of a 1997 wind event northwest of Steamboat Springs, spruce beetle started in large-diameter downed timber and spread to nearby

standing spruce. As a result, forests are mostly devoid of large spruce throughout Routt and Jackson counties. Spruce beetle infestations are increasing in the southwest mountains of Colorado. A wind event in June 2007 affected almost 1,000 acres in the Wet Mountains of the San Isabel National Forest. A 2008 survey identified broods of spruce beetle that may be problematic in the future.

Western spruce budworm defoliates Douglas-fir, spruces, and true firs. The larvae of this moth chew newly produced foliage in early summer, and heavy feeding for 2-3 years can kill host tops and entire trees. Colorado experienced a major cycle in the 1970s and early 1980s and is due for another. Increased populations noted along the Front Range in the Rampart Range near Colorado Springs, north of Durango, and around the Telluride area indicate the expected upsurge may be underway. Historically, Douglas-fir has been hardest hit and this



Ingrid Aguayo

Tent caterpillar and spruce budworm damage (left) on Cuchara Pass.

A high country stream near Vail (right) photo Ingrid Aguayo.

others began surveys back in 1986, it has been detected dozens of times. A few of these incidences proved to be established infestations and were eradicated. In 2008, 1,600 detection traps utilizing pheromones were placed throughout Colorado and one moth was detected.

The **walnut bark beetle** and **two canker fungi** are the known organisms involved in a new problem referred to as **thousand cankers disease of black walnut**. The beetle is thought to be native to Arizona walnut in the Southwest, and new to black walnut and to Colorado. Its involvement with the *Geosmithia* fungus also is new. How these organisms got here is a mystery. To date, most of the black walnuts, including the state champion in Denver, are dead or in harm's way. To date, no preventive or curative measures exist, although progress has been made.

Another exotic looming in our future is the **emerald ash borer**. A pest of major consequence, it was introduced into Detroit from Asia in the 1990s via packing materials, and already has killed millions of ash trees in Michigan and bordering areas. Its primary means of spread is via firewood or other wood products with the bark attached. The closest known infestation is in eastern Missouri, a day's drive from Colorado. The CSFS, along with the Colorado Department of Agriculture and USDA-Animal Plant Health Inspection Service, has actively conducted surveys for the past four years, including 140 trap sites in 2008. To date, no emerald ash borers have been detected in Colorado.

conifer tends to occur at lower elevations than the other hosts.

Western tent caterpillar has a long history in Colorado. This defoliator of aspen and other deciduous trees and shrubs, long absent from traditional areas, is experiencing an upsurge and currently is active in the San Juan Mountains north of Durango and in portions of the Wet Mountains.

Minor bark beetles fail to kill large numbers of trees that grab front page headlines, but they do cause concern locally. When mountain pine beetle or spruce beetle successfully attack pine and spruce trunks, respectively, ips beetles and other smaller species called "twig beetles" commonly colonize branches and twigs. Because vast bark beetle events are active at present, the corresponding populations of the smaller beetles also are vast. This has allowed large populations of these smaller beetles to kill small trees outright, but is predicted to cease within a year or two after activity by the larger species drops off.

Exotic organisms are those that are not native to new areas where they currently are present. The term "exotic" can apply to a Colorado mountain

species introduced to a town on Colorado's Eastern Plains, an Arizona species blown by the wind to Colorado, or a foreign organism hiding in a pallet brought to a loading dock in Denver. Following are examples of exotic organisms relevant to Colorado:

Gypsy moth is a Eurasian defoliator of many trees, mostly deciduous species, that established itself in the Northeast in the 1860s. During the egg and pupal stages, it hitchhikes on vehicles and outdoor objects. Since the CSFS and



Gypsy moth detection trap.



The Composition of High Elevation Forests

Conifers dominate the vast expanse of Colorado's high elevation forests. A closer look reveals that they are individually mingled with the upper reaches of lodgepole pine forests. Blue spruce, bristlecone pine, limber pine, and white fir add to the portfolio. Aspen can be found in the mix at elevations ranging from 9,000 to nearly 12,000 feet.

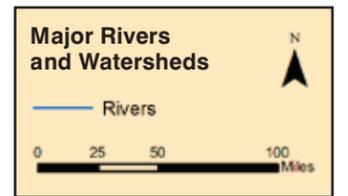
High Elevation Forests and Watersheds

Colorado's high elevation forested watersheds provide water for Colorado's population and those of many neighboring states. It is important to note that virtually all of Colorado's drinking water comes from snowmelt carried at some point by a river. The four major river systems (Platte, Colorado, Arkansas, and Rio Grande) originate within the mountains of Colorado and drain fully one-third of the landmass of the lower 48 states. About 80 percent of Colorado's precipitation falls on the

West Slope while about 80 percent of the state's population lives on the East Slope between Fort Collins and Pueblo.

The relationship between forests and water is complex, but simply stated, the forest canopy intercepts precipitation that falls toward the ground from clouds. The deposition of fallen moisture in forests depends on several things, but foremost are the physical state of the water (liquid or solid), the density of tree crowns on which it falls, and the composition of the forest floor.

High elevation forests are the first in line to receive fallen moisture, and their health is directly related to the vigor of Colorado's watersheds.



High Country Fire

High elevation forests are cool and wet, and every so often, sometimes with centuries elapsing between events, they burn. Spruce and fir forests in Colorado burn roughly every 200-400 years. The “mean fire return interval” (MFR) is so infrequent in these areas that fire’s potential and influence are easy to miss. But the subalpine zone depends on fire to function naturally.

Many factors, some obvious, some not so apparent, contribute to the infrequent, but intense, fires that occur in high elevation forests. The age, density, and composition of forests, combined with the right weather conditions, all contribute to fire risk and behavior. Because high elevation forests generally are cool and moist, a significant period of drier, warmer weather is necessary for intense fires to occur. The typical life cycle of high elevation forests is 200-400 years; thus, they may appear to be unchanging to human observers. However, when forest conditions are ripe for change, the results can be dramatic. Thousands of acres may burn at one time, and since the forests grow slowly, the recovery also is slow.

Perhaps most important are the watershed implications of landscape-scale fire in upper montane and subalpine forests. The direct impacts of fire to power and water transmission infrastructure, homes, skiing, and other recreation facilities also are immense.

It may be unavoidable to eliminate big fires, but through active management and human behavior based on the unique characteristics of the trees and land, it is possible to influence where fires occur.

A subject of major current interest is the issue of increased fire hazard in lodgepole pine forests recently affected by pine beetles. Beetle-killed trees may contribute to fire and fire-related issues by adding volumes of dead woody fuels, falling across power lines, blocking access roads used by firefighting personnel, or as a result of additional ignitions caused by equipment or people engaged in clean-up activities. Fire hazard is high while dead needles remain on the trees. After the needles have dropped, but while



Paul Mintier

the trees remain standing, fire hazard may be relatively low. Hazard once again increases when the trees fall to the ground and forests are regenerating. Fires that occur at this time can be intense due to large amounts of dead and downed trees, and new growth.

If the effects of climate change accumulate according to prevailing predictions, the following can be expected: more fire escapes, faster spread of fires, an earlier fire season, a longer fire season, bigger fires, more ignitions, longer-burning fires, and an increase in the size of the area vulnerable to fire.

The most pressing challenges in defending lives and property are to modify structures and forests in their immediate vicinity to reduce fire hazards and improve their defensibility; address the fire risk associated with falling beetle-killed trees; manage selected areas of spruce and fir forests to limit large fires and the resulting damage to watersheds and water resources; monitor beetle-killed forests in their recovery from the recent epidemic to learn from, and respond adaptively to, the process; do what we can individually and as a society to slow human contributions to climate change and associated fire implications.



Deborah Carr

In 2007, a fire broke out at the YMCA Snow Mountain Ranch near Winter Park (top and above).

Results of forest management on the King property in Lake County (both opposite), photos Damon Lange.

A High Country Case Study: Lake County Landowner Keeps the Forest Green and Growing

The view of the open meadow surrounded by pine trees and snow-capped mountain peaks on the King family property in Lake County epitomizes the image of Colorado that so often graces the cover of magazines.

Located five miles southwest of the City of Leadville near Half Moon Creek, the 113-acre property has been in the King family for over 100 years. The 1870 U.S. Census for Lake County lists Jon and Delilah King as the owners. He was a farmer from Pennsylvania, and she was from Ohio.

The original owners might be happy to know that the portion of the property inherited by the current owner is still undeveloped and remains much as it was over 100 years ago. Implementation of a forest management plan developed by the Colorado State Forest Service in 2004 will help keep the forested land healthy for the next generation to enjoy.

The average age of the trees in the lodgepole pine forest on the King property is 125 years. Currently infested with dwarf mistletoe, the trees are susceptible to bark beetles. The mountain pine beetles (MPB) that have affected more than 1.5 million acres of mature lodgepole pines in Colorado are working their way to the south of a stand in Box Creek on the King property, so efforts are underway to promote regeneration and establish a younger, healthier stand.

This management objective of creating a healthier, more diverse forest is being accomplished by clearcutting the 16-acre stand. Lodgepole pine is referred to as a pioneer species that regenerates after a catastrophic event such as a large wildfire.



Wildfires create openings that allow additional sunlight, encouraging the growth of lodgepole seedlings. Clearcutting in lodgepole pine mimics wildfire and is a proven practice to regenerate lodgepole pine stands.

Building on lessons learned from the epicenter of the MPB epidemic in Grand County, Damon Lange, Salida District forester, Colorado State Forest Service, worked with the King family to determine the best course of action given current levels of infestation in the area.

Rather than wait until the epidemic established itself locally, the King family decided to harvest the stand, so they worked with Lange, who inventoried and advertised a timber sale that was purchased by a local contractor in nearby Buena Vista. Had the King family waited until the infestation had progressed, the health of the trees on the remainder of their forested land would have been compromised and they might have had to pay a logger to remove the infested, dead wood.



Forestry Gets a Helping Hand from the Colorado General Assembly

The state of Colorado values healthy, resilient forest landscapes and is willing to invest state funds in the stewardship of these resources. In 2008, the Colorado General Assembly passed seven bills and three joint resolutions addressing forest health, fuels mitigation, and public safety (see chart below). This unprecedented level of legislative activity is evidence of the importance of Colorado's forests.

At the time this report was written, several forestry-related bills were being drafted for consideration by the 2009 Colorado General Assembly. The bills are aimed at creating legislation that promotes healthier, more diverse forests that are resilient to insect and disease epidemics for the benefit of present and future generations.

The Future

The easy answer to questions about the future of Colorado's high elevation forests is "succession."

The current mountain pine beetle epidemic will either finish in lodgepole pine or switch to ponderosa pine before eventually winding down. The result will be the inevitable turnover of older, mature pine forests and the beginnings of the next forest. Facing this event will require managing the risk of increased hazard to people and infrastructure from falling dead trees and elevated fire danger. Utilizing the wood and capturing carbon, either by converting blue-stained trunks to products with long lives, or turning ghost forests into biofuel that replaces fossil fuel, can help address the situation. And in some places, it may be necessary to intervene in the structure of the next forests by thinning naturally established, high-value lodgepole forests early in their lives.

Preventing and dealing with landscape-scale fires that threaten watersheds within the lower mountains is imperative. Fires like Buffalo Creek, Hayman, and other recent fires provide evidence about the consequences of failing to protect water resources and the investments that have been made to move and store water supplies. And it is paramount to learn more about how fire functions in the upper montane and subalpine forests, particularly with respect to major watersheds.

Just when the pine beetle finally runs its course, several other major insect events are ripe for return. Western spruce budworm, spruce beetle, western tent caterpillar, and others will be prominent in the coming decades. They will impact mixed conifers, spruce, and aspen, respectively. Additionally, exotic organisms will enter the system, and will need to be detected and eradicated as quickly as possible.

Summary of 2008 Forestry Legislation

Bill Number	Bill Name	Bill Summary
HB 1110	Income Tax Deduction	Five-year program that allows a landowner to deduct the actual costs of wildfire mitigation up to \$2,500.
HB 1269	Sales and Tax Exemptions for Beetle- Killed Trees	Exempts beetle-infested logs and products made from such logs from state sales and use taxes.
HB 1318	Mitigating the Effects of the Pine Beetle Infestation	Establishes a beetle mitigation fund that allows the public to make voluntary donations that can be used to treat beetle-infested state-owned lands.
SB 71	Extend the Forest Restoration Pilot Program	Extends for 5 years the Community Forest Restoration Grant Program that was established in 2007 through the passage of HB 1130. Grants are available to communities for fuels mitigation and restoration.
SB 221	Watershed Bonding for Forest Health	With proper authority and agreement, bonds can be issued for forest health and watershed protection projects.
SB 232	CSU Agency Line Item Authorization	Authorizes the General Assembly to appropriate funds directly to the Colorado State Forest Service, Agricultural Experiment Station, and CSU Extension.
SB 39	Training Directors of Fire Protection Districts in the WUI	Directs the Division of Fire Safety to develop a pilot education program for Board members of Fire Protection Districts in the wildland-urban interface.
HJR 1033	Colorado Forest Health	Promotes active management in National Forests impacted by bark beetles.
SJR 10	Concerning Stewardship Contracting	Requests that the USFS, BLM, and CSFS work together to identify and implement up to three long-term stewardship contracts.
SJR 25	WUI Interim Committee	Creates an eight-member interim committee to hold hearings on issues related to the WUI, fuels mitigation, firefighting, tree mortality from bark beetles and incentives for forestry-related industry.



Dave Leatherman

Sudden Aspen Decline may simply be an expression of drought, or it may be something new and more complex. The question is whether there will be adequate moisture during the next few critical years for aspen, alongside young evergreens, to fill holes in the pine forest opened up by bark beetles.

Perhaps the most pressing unknown is climate change. Its effects on biological cycles and phenomena like fire are likely to be negative. Perhaps the most promising solution is to encourage forest growth and adopt lifestyles that, in balance, sequester carbon.

Forestry has always been "green," but perhaps it can be a shade greener by finding new uses for wood. The technologies and economics of biofuels, including those involving wood, are rapidly improving.

Forests are essential for our continued well-being. They provide us with wood products, wildlife and fish

habitat, scenic beauty, and recreational opportunities—and they contribute to clean air and water.

To protect the benefits that Colorado's forests provide well into the future, the Colorado State Forest Service is working with numerous partners and stakeholders to develop a statewide strategic forest resource assessment. The assessment will provide an analysis of present forest conditions, and future forest trends and threats across all ownerships in Colorado. The assessment also will identify gaps in data that need to be addressed in the future so that, collectively, we can make informed decisions about the stewardship of our forests. Specifically, the assessment will focus on how to conserve working forest lands; protect forests from harm; and enhance public benefits from trees and forests.

After the assessment is completed, the CSFS will again work with partners and interested stakeholders to develop

a strategy that addresses the most critical needs in the three focus areas noted above. The strategy will provide a long-term, comprehensive, coordinated approach that concentrates and leverages future resources to achieve the greatest benefit while addressing the most critical forest health needs.

Colorado has 22 million acres of forests. They make our state the grand place it is, aesthetically and in the marketplace. Clearly, challenges abound. But Colorado's forests will persist and survive, and, hopefully, those who are fortunate enough to call Colorado home will continue to learn from them.



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